

# CHEMICAL DISINFECTION OF EXCRETA.

WM. DREYFUS, SC. D.,  
*New York.*

Read before the Laboratory Section, American Public Health Association, Jacksonville, Fla.,  
December 1, 1914.

The objections of the privy system which now prevails in rural districts, and too often, be it said, in cities, are recognized by all. The evil consequences that may follow the present methods of disposal of "night soil," where there is no proper sewerage system, are apparent to physicians and sanitarians and, I am glad to say, to a great number of people in general.

Yet the privy which contaminates the air and soil, pollutes the water, poisons wells and causes disease and death, has been generally accepted as a necessary evil, even by people accustomed to the comforts and privacy of a water closet in a city, and who desire to have an equivalent in the country, and efforts to provide a substitute have been considered of little avail in many communities. Even health officials charged with the safeguarding of the lives of the people have, in many instances, deemed it sufficient to direct that the privy be not located within fifty feet of a well or spring, and that there be a frequent removal of excreta.

In recent years, however, there has been a change of sentiment on the part of many people, and state and local health authorities have been beset with inquiries as to substitutes for the present death-dealing privy vault. This, no doubt, has been brought about, to a considerable extent, by the dissemination of information on the septic tank process of purification of sewerage. Still, there is good reason to believe that the campaign against the typhoid fly conducted with such vigor within the past decade, and the education on prevention of hookworm disease, have had much to do with the awakening of the people.

Two types of sanitary privies are generally recognized, namely, the so-called "dry system" and the so-called "wet system."

The objections of the present day, "wet and dry system," however, have been so ably described by Doctors Lumsden, Roberts and Stiles, in a Bulletin of the United States Public Health Service, issued in February, 1911, that I will not enter into the details here, but will simply explain to you the results of an investigation extended over the last twelve months with a type of sanitary closet which is marketed commercially and which will decrease the disadvantages, and at the same time increase the advantages connected with the older type of outhouse.

The apparatus is a well-made and handsomely designed cabinet which conceals a strongly built tank of twenty-four gauge steel, heavily galvanized.

The tank should contain about three inches of water to which is added a germicide specially adopted for this purpose and being guaranteed to possess a Hygienic Laboratory Phenol Coefficient of 9 to 10.

The covers of these closets are so fitted as to make them practically airtight. The lower member of the lid overlaps on the side of the cabinet, and the upper member of the lid is fitted with a rubber cushion projection, which, when closed, fits snugly into the shaped seat-hole.

The air enters into the cabinet at the bottom through air intakes, circulates around the containing tank and escapes, carrying with it every vestige of odor through a four-inch vent pipe which passes on to the chimney.

The practical working of this closet is most simple and free from objectionable odors and the emptying of the tank can be done intermittently by means of a pump attachment or by continuous flow if found desirable. The closet can also be provided with an automatic mixing arrangement so that the contents are thoroughly mixed each time the closet is used or with an automatic appliance discharging a new supply of disinfectant, approximately one quarter ounce of a 10 per cent. solution of the disinfecting fluid mentioned above, being added each time the closet is used.

In the following charts the results of the germicidal action of the disinfectant used are indicated for a closet with the automatic attachment and for a closet without the automatic attachment. Each experiment was carried out at the same time on two closets, one called "Test Closet" and the other "Control Closet," each closet being used by a squad of six men each for a period of from three to four weeks. In the "Control Closet" only water was used, while the "Test Closet" contained at the beginning of the experiment a 2 per cent. solution of the disinfecting fluid mentioned above equal in volume to the water in the "Control Closet."

Chart No. 1 represents the results on "Test and Control Closets" with automatic attachments such as mixer, supply tank, and discharging pump and was in use from June 15 to July 21, each closet being used by a squad of the same six men during the whole period. Samples were taken from the closets on June 25, July 2 and July 21, representing seven, fourteen and twenty-eight days' actual use, respectively (Saturday afternoons and Sundays, being holidays, are not counted). On each of these dates two samples were taken from each closet, one from the inside and one from the pump. Care was taken throughout to treat each sample in exactly the same way so that the results might be truly comparable.

During the period of the test the following deposits were made:

Test Closet. . . . . excreta, 67; urine, 170.

Control Closet. . . . . excreta, 117; urine, 234.

It should be noted that at no time during the test did the test closet contain an appreciable amount of solid material, only a few pieces of formed

stools being present at any time. On the other hand, the control closet contained at all times during the test a large amount of solid material consisting of large well-formed stools and paper. This confirms the fact that the disinfecting fluid has a decided disintegrating action upon fecal material.

## BACTERIOLOGICAL EXAMINATION.

Closet.	Sample.	Date.	Colonies per cc.				B. coli per cc.
			Infusion Agar 48 hrs. at 37°C.	Infusion Agar 5 days at 20°C.	Litmus 48 hrs.	Lactose Agar at 37°C.	
					Total.	Red.	
Test	No. 1 Inside	6-23-14	160	200	160	0	0
Test	No. 2 Pump	6-23-14	140	200	110	0	0
Test	No. 5 Inside	7- 2-14	90	120	100	0	0
Test	No. 6 Pump	7- 2-14	80	100	100	0	0
Test	No. 10 Inside	7-21-14	400	160	180	0	0
Test	No. 10 Pump	7-21-14	300	120	160	0	0
C'trol	No. 3 Inside	6-23-14	92,000,000	74,000,000	81,000,000	466,000,000	18,000,000
C'trol	No. 3 Pump	6-23-14	71,000,000	53,000,000	75,000,000	41,000,000	19,000,000
C'trol	No. 7 Inside	7- 2-14	130,000,000	120,000,000	190,000,000	120,000,000	90,000,000
C'trol	No. 8 Pump	7- 2-14	190,000,000	160,000,000	110,000,000	90,000,000	60,000,000
C'trol	No. 11 Inside	7-21-14	11,000,000	22,000,000	9,000,000	6,000,000	4,000,000
C'trol	No. 12 Pump	7-21-14	8,000,000	16,000,000	6,000,000	4,000,000	2,500,000

CHART No. 1.

The results of the test are entirely satisfactory. The fluid contents of the test closet might have been disposed of at any time in any manner esthetically acceptable, and would not possibly become a menace to health.

Chart No. 2 represents Test and Control Closet of plain simple construction, no provision being used for the automatic mixing of the contents or for the addition of new supplies of disinfectant. Each closet was used by a squad of the same six men from August 24 until September 25 when samples were taken from each closet, both before and after thorough mixing. The closets were then allowed to stand without use until the morning of September 28 when the contents were again sampled. During the period of the test the following deposits were made in the closets:

Test Closet . . . . . excreta, 86; urine, 210.

Control Closet . . . . . excreta, 71; urine, 273.

It will be noted that in each case the unmixed samples from the test closet show very satisfactory results. The results on the mixed sample

## BACTERIOLOGICAL EXAMINATION.

Closet.	Sample.	Date.	Colonies per cc.				B. coli per cc.
			Agar 48 hrs. at 37° C.	Agar 5 days at 20° C.	Litmus 48 hrs.	Lactose Agar at 37° C.	
					Total.	Red.	
Test	Not mixed	9-25-14	1,500	3,000	1,700	1,700	6
Test	Mixed	9-25-14	32,000	22,000	42,000	42,000	5,600
Test	Not mixed	9-28-14	600	600	550	550	0
Test	Mixed	9-28-14	450	500	390	390	0
C'trol	Not Mixed	9-25-14	16,000,000	18,000,000	10,000,000	2,000,000	1,200,000
C'trol	Mixed	9-25-14	154,000,000	100,000,000	131,000,000	16,000,000	8,000,000
C'trol	Not mixed	9-28-14	140,000,000	170,000,000	154,000,000	54,000,000	42,000,000
C'trol	Mixed	9-28-14	160,000,000	150,000,000	131,000,000	37,000,000	28,000,000

CHART No. 2.

taken from the test closet on September 25 are not as satisfactory as might be desired. However, when the contents were allowed to stand for seventy-two hours, the bacterial counts, both on the mixed and unmixed samples, show a very complete and satisfactory degree of disinfection, such as would render the contents entirely non-injurious to health.

Chart No. 3 represents Test and Control Closet in use from September 29 to October 27 in which was used Commercial Formalin as a disinfectant.

The details of this test were precisely the same as in those mentioned above. The closets were of simple construction, no special attachments of any kind being provided. At the beginning of this experiment, one closet contained six gallons of a 1 per cent. solution of Commercial Formalin; the other closet a like column of a 2 per cent. solution of Commercial Formalin. As a control closet, containing water only, had been used so often in previous tests, it was not considered necessary to include such a closet in this experiment.

Each closet was used by a squad of six men and, during the period of the test, the following deposits were made:

Closet No. 1, 1 per cent. Formalin . . . . . excreta, 88; urine, 274.

Closet No. 2, 2 per cent. Formalin . . . . . excreta, 86; urine, 343.

Samples were collected from the closets on October 8, October 19, and October 27, representing one, two and three weeks of actual use respectively. In every instance two samples were taken from each closet, one before and one after thorough mixing. The bacteriological results are shown in the following tabulation:

## BACTERIOLOGICAL RESULTS.

Closet.	Sample.	Date.	Colonies per cc.				B. coli per cc.
			Agar 48 hrs. at 37° C.	Agar 5 days at 20° C.	Litmus 48 hrs.	Lactose Agar at 37° C.	
					Total.	Red.	
No. 1							
	Formalin Not mixed	10- 8-14	30,000	30,000	31,000	21,000	16,000
	Formalin Mixed	10- 8-14	1,510,000	690,000	700,000	600,000	380,000
	Formalin Not mixed	10-19-14	10,000	12,000	14,000	9,000	6,000
	Formalin Mixed	10-19-14	1,800,000	1,200,000	1,300,000	890,000	580,000
	Formalin Not mixed	10-27-14	1,340,000	2,600,000	1,900,000	980,000	620,000
	Formalin Mixed	10-27-14	62,000,000	59,000,000	48,000,000	27,000,000	19,000,000
No. 2							
	Formalin Not mixed	10- 8-14	5,000	6,000	1,400	0	0
	Formalin Mixed	10- 8-14	127,000	99,600	170,000	120,000	65,000
	Formalin Not mixed	10-19-14	2,000	3,400	1,800	0	0
	Formalin Mixed	10-19-14	230,000	390,000	280,000	190,000	96,000
	Formalin Not mixed	10-27-14	12,000,000	10,000,000	9,000,000	8,000,000	4,500,000
	Formalin Mixed	10-27-14	92,000,000	112,000,000	68,000,000	47,000,000	29,000,000

CHART No. 3.

The results with the 1 per cent. solution of Formalin show in no case a satisfactory degree of disinfection. With the 2 per cent. solution the results with the unmixed samples are fairly good for the first two weeks, while the reverse is true with the mixed samples, showing that the Formalin does not have the power to penetrate masses of fecal material. The samples for the third week show results nearly, if not fully as bad as might be expected with a closet in which water only had been used. This would indicate that the Formalin solution is quickly exhausted.

It is worthy of note that from the microscopic appearance of the contents of these closets a solution of Formalin has a much less disintegrating action upon fecal material than water alone. This view is also borne out by the bacteriological results.

In conclusion it may be said, that in the strength used and under the conditions of this test Formalin can not be considered as a safe and satisfactory disinfecting agent for fecal material.

It might be of interest to mention that further work will be continued to investigate the action of the disinfection of hookworm larvæ and eggs and if possible on other organisms of parasitic origin, by means of the same type of sanitary closet and disinfectant as described above.